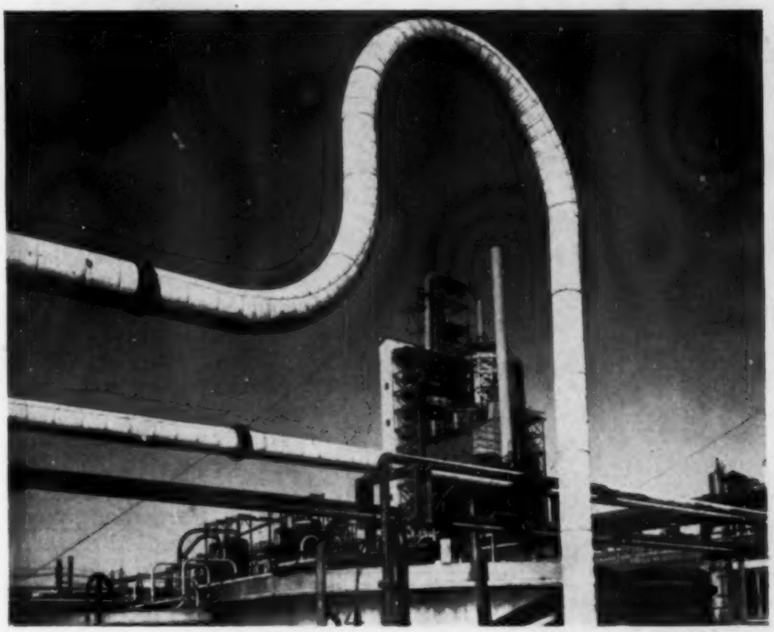
The Science Teacher



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A National Service Journal

Listed in Education Index

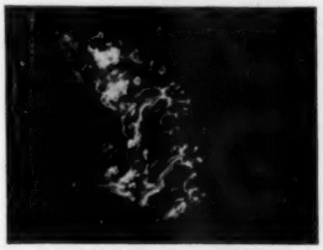
Science Shorts

ON SUBJECTS YOUR STUDENTS WILL ASK YOU ABOUT

Vincent Schaefer making snow in the laboratory cold chamber.

MAN-MADE SNOW

Man-made cloud which consists of millions of tiny water droplets.



Transformation of cloud a few seconds after it is seeded with ice germs.

In a few more seconds' time, the cloud reveals a few tiny flakes of snow.

The finished product—SNOW!

MAN-MADE SNOW was first created in the Research Laboratory of General Electric by Vincent Schaefer. This method, applied on a larger scale, may make it possible to precipitate snow before it reaches urban areas, to cause it to fall on ski slopes, to remove dangerous icing conditions from the flight paths of planes.

Natural clouds, from which snow is formed, consist of "supercooled" water droplets. Water in this condition is not frozen, even though it is far below the freezing temperature.

A SUPERCOOLED CLOUD is produced in a laboratory cold chamber similar to a home freezing unit by dropping temperature to about minus five degrees Fahrenheit and then introducing moist air. The moist air condenses into a fog of supercooled droplets. To provide nuclei upon which snow crystals can be built, the cloud is "seeded" by passing through the chamber a tiny pellet of dry-ice, which is solid carbon dioxide at a temperature of minus 70 degrees Fahrenheit. This seeding can also be accomplished by passing through the chamber a small metal rod, cooled below minus 31 degrees Fahrenheit.

The seeding results in formation of submicroscopic ice particles in the air close to the surface of the cold object. The mechanism of formation is not fully understood, but an almost infinite number of ice germs form in this manner.

CRYSTALS begin growing at the expense of the water particles once they get started freezing, and continue in something like a chain reaction, forming tiny snowflakes. These flakes are genuine snow crystals, similar to the "diamond dust" that falls in the mountains on cold mornings. They are about 1/50th the size of an average natural snowflake.

A REAL CLOUD was transformed into snow by this same method when Mr. Schaefer, flying in an airplane, seeded a three-mile-long cloud with six pounds of small dry-ice pellets. The process was the same—the only difference was that the cloud was real and not made in a cold chamber.

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The Science Teacher

VOLUME XIV APRIL, 1947 NUMBER 2

The Necessity of Science Legislation[1]

K. LARK-HOROVITZ
Department of Physics,
Purdue University

The first two articles of this journal present the final part of a forum discussion of "Problems of the Science Teacher" by members of the Cooperative Committee of Boston of the National Science Teachers Association. The balance of the discussion appeared in the February issue and was given by Professor Schorling, Dr. Quill, and Dr. Meister.—Editor.

DISCUSSIONS throughout recent years and evidence presented tonight[2] have made it abundantly clear that the nation is facing a crisis in science teaching. This crisis is primarily due to these facts:

(1) that we lack the number of teachers necessary to teach the basic principles of science,

(2) that many of the presently employed science teachers are inadequately prepared[3],

(3) that a great many of the schools are inadequately equipped[4] to offer effective science instruction and particularly laboratory experience, and

(4) that many able youths capable of being trained in science cannot take advantage of available opportunities because of limited financial resources.[5]

It is well recognized that because of the economic variations in the country there are many communities which do not have the taxable resources to support independently an adequate educational program.[6]

It is difficult to foresee how substantial improvement can be made without provision of *special aid for*

(1) communities of limited taxable resources,

(2) individual students of limited economic resources.

There is, however, some reluctance on the part of the communities to promote a program of federal aid to education, because in a great many instances, the tax payer feels that federal aid means federal control.

HOWEVER, while it is not always recognized, this nation has, almost from the beginning, supported programs of federal aid to education, as is evidenced by land grants and the several acts providing for vocational education. With the exception of the early land grants to the common schools, this aid has been directed toward certain special fields of education considered to be important to the country as a whole, such as agriculture and trades and industrial vocational education. During the last few years, we have witnessed federal support for an adult education program of unheard of extension, the War Production Training Program and the Engineering Science Management War Training pro-

1—Based in part on a committee report, "On the Teaching of the Basic Sciences," *American Journal of Physics*, Dec., 1944, pp. 359-362.
For history and bibliography regarding federal aid to education see United States Office of Education, Circular No. 162, Sept., 1936; Leaflet No. 30, 1937; and Leaflet No. 77, 1946. Compare also with provisions of Bill S1316, High School Science Education Act of 1945, Bill S181, Bill S1850, and Senate Subcommittee Report No. 8, 79th Congress, Second Session.

2—See R. W. Schorling: "Recruiting and the Economic Status of the Science Teacher," *The Science Teacher*, Feb., 1947, p. 11.

3—Data secured in the fall of 1946 from the state departments of education show that substantial numbers of positions in science and mathematics are not filled and an even greater number of positions are filled by people on emergency certificates or permits. A survey of some 27 colleges and universities shows a deplorable lack of interest on the part of students in science and mathematics teaching.

4—Some of the states spend as little as $28.00 per year per child, an amount obviously insufficient to maintain adequate science equipment. N.E.A. *Journal*, May, 1946, p. 236.

5—It is estimated that the group of able students who do not reach college, "is as large, or nearly so, as the entire body of students now in college." *General Education in a Free Society*. Harvard Press, 1945, p. 88. See also *Science The Endless Frontier*, Washington, D. C., 1945, Appendix A, p. 158 and following.

6—Taking the average annual income payments for the five years 1939 through 1943 as a basis, 2.04% in Arkansas provides not quite $30 per year per child, 2.34% in Mississippi provides not quite $28 per year per child, but 2.07% in California provides $110 per year per child.

gram; and we have now another adult education program, again with federal support, the Veteran's Education program.

Throughout all these experiences, it has become clear that federal support does not mean federal control. Each state has to meet certain standards in equipment, program and administrative organization in order to become eligible for federal aid; but this involves only a very small degree of federal control. The acts establishing federal aid can and have been written in nearly all cases to limit federal control to a minimum.

To help the cause of science education, it is advisable

(1) to extend the existing legislation relating to vocational and technical education, and

(2) to formulate future legislation which would provide in addition to such fields as vocational agriculture, home economics, and trades and industry, federal aid for education in the basic sciences, including mathematics.

Federal aid should contribute to more adequate salaries for science teachers and thus enable the teaching field to compete more effectively with industry in attracting able people.

EXISTING and future acts providing federal support should include provisions for teacher training. This would provide funds which would make it possible to raise the standards of preparation of science teachers. It would also make it possible to provide in-service training for the science and mathematics teachers by providing counselors and itinerant science experts to visit the schools during the school year and science teacher workshops during the vacations at strategically located training centers. In Indiana the cooperative effort of the Technical Extension Division of Purdue University, its engineering school and the division of education provides counselling in the fields of mathematics and science.[7] This is a part of a program in which Indiana University, Butler University, and the State Teacher's Colleges all cooperate. Such programs should be established throughout the country. This is not unjustified if one considers that the teaching of the sciences is intimately related to the whole program of vocational and technical education.

State participation should be on a voluntary basis, with federal resources used to supplement the funds that any state is able to provide. Various matching safeguards can be provided in any legislation to insure that the initiative does not lie wholly with the federal government.

Federal aid should as well be directed wherever necessary toward the development of post high school technical institutes. By setting up proper advisory committees, representing not only the technical vocations, but also the sciences, one would guarantee that the interest of the groups vitally concerned would be adequately considered in the development of the program in the several states.

A program of this type requires federal aid, but would really bring about only a minimum of federal control, because the major initiative would still be with the state and local community. Judging by the work of the vocational education program, one can be assured that the influence of such science legislation would result in the raising of standards in teacher training and in the improvement of teaching itself, and therefore federal aid would have a wholesome influence on the development of science and the understanding of science in this country.

WITH reference to the second area of great need, one of the most important recommendations of the President's Committee concerned with the future development of science in this country and summarized in the report, "Science, the Endless Frontier," was the recognition of the necessity to provide a great number of scholarships for the young men and women who are to be trained in the basic sciences. Many colleges and universities provide within the limitation of their budget scholarships varying in amount from free tuition to grants adequate for personal support. A pioneering effort in the field of science was the founding of the Science Talent Search of Science Service for the Westinghouse Scholarships. While this admirable undertaking reaches only a small number of students, the

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7—For details see R. W. Lefler, "Science Counseling in Secondary Schools," *School Science and Mathematics*, March, 1947, pp. 215-221.

Resume*

A. J. CARLSON
Department of Physiology, University of Chicago

1. When the facts are stated comprehensively, clearly and without prejudice, that alone is a major aid to the real solution of any problem. I think we will agree that our four colleagues have stated the facts clearly, comprehensively and without prejudice, and our problem is this: How can we contrive a more adequate education in science for our people?

2. There can be no question, so far as I understand man, nature, and our processes of learning, that adequate laboratory equipment and adequate laboratory time for teachers and students are necessities for effective education of our youth in science. Books are not enough, even the most up-to-date books. Oral teaching is not enough, even if all our colleagues were A-1 teachers. Demonstrations by the teacher are not enough. There must be a minimum of individual laboratory and field work on the part of every student in order that the scientific method, which has led, and will continue to lead, to a more complete understanding of man and nature, is to be mastered by our students.

There is no rivalry between the laboratories of science, field work in science, and the traditional three R's, including the social studies and the humanities in our program of liberal education, at least in the view of those colleagues and citizens who have a proper understanding of the needs of modern education. Some myopic colleagues have seen a threat to the so-called liberal education of the past in the growing needs and importance of education in science. Our citizens of tomorrow need the more realistic—that is, scientific—understanding, both of man and nature; and the understanding of man is impossible without some understanding of man's past, both physical and intellectual—that is to say, man's environement. It need not be pointed out that the application of modern science changes man's environment faster than such changes have ever taken place in the past, and unless these changes are understood and guided for the welfare of man we are not living up to our name *Homo sapiens*.

It should also be pointed out that science laboratories and laboratory facilities are necessary for the continued growth and the maintenance of the intellectual life of the science teacher. Every science teacher must, to a certain degree, be a scientist and continue to work in science throughout his or her life. Otherwise science teaching will soon be stale and ultimately ineffective.

Laboratories and laboratory facilities could also be an effective aid in continued adult education in science, if our nation ever could get started on continued adult education in order to take up the slack produced by our failure of the past. Such continued adult education has achieved some success and value in other countries—why not here? Laboratory demonstrations are an obvious necessity in any effective program of continued adult education in the understanding of man and nature.

3. It is humiliating to be informed that we, as a nation, spend annually more of our income for alcoholic liquors than for our schools—that is, for the education of our children; that we spend annually much more for cosmetics than for our schools. On the basis of these facts it is clear that past and present failure in our national efforts towards education of our children cannot be ascribed to national poverty. It must be ascribed, in part, to our lack of understanding of the primary importance of education of our children.

Because the practical applications of modern science change our environment relating both to food and health, education in the fundamental sciences is more imperative for the life of the children tomorrow that was or is such education under more primitive conditions of life. But our colleague, Dr. Schorling, is clearly on the beam when he points out that providing more funds and larger salaries for our teachers (including our teachers of science) will not by itself cure all the imperfections in our educational efforts. We cannot produce A-1 teachers by cash alone. Some-

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*Given at the forum discussion of "Problems of the Science Teacher" by members of the Cooperative Committee of the AAAS at the December, 1946 meeting at Boston of the National Science Teachers Association. Dr. Carlson served as moderator.

We Have Lost a Generation

MORRIS MEISTER
President of NSTA

MISTAKENLY, the public believes that the war produced many scientific advances. Actually, there was no time for research. Teams of the best scientific minds attacked immediate, pressing problems. They drew upon the fund of existing knowledge. Very little, if anything, was contributed to basic science. The atom bomb, radar, the proximity fuse and all the rest were applications of laws and principles known before the war.

In the words of Raymond B. Fosdick, "War blocks scientific progress and, through perverted applications, debases the whole concept of the dignity and glory of man's conquest of nature." To make matters worse, we permitted the war to absorb and consume our scientific personnel without providing means for its replacement. In a "policy of desperation" we "placed a crippling mortgage on the future." To make a "day's feed for the war machine," we "have sacrificed the seed corn; we have lost a generation."

What is the present situation? At precisely the time when we must have scientifically trained men and women, the supply is woefully short. At the moment when we need citizens who appreciate what science can do for human welfare, we lack the teachers for the task. Inadequately prepared teachers, poor equipment, low salaries, and a dearth of laboratory experience, conspire to restrict still further the flow of essential personnel. And thousands of science talented youth cannot, for financial reasons, take advantage of such opportunities as are available.

That is the crisis which we now face in this country. That is the problem upon which the spotlight was thrown by the Forum of the Cooperative Committee on Science Teaching of the AAAS when it met with the NSTA in Boston last Christmas.

OBVIOUSLY, such an emergency calls for new governmental responsibilities. In the last analysis, it means legislation and an adequate budget for carrying the laws into action. It means, too, that scientists and science teachers everywhere must unite to bring this public need to the attention of legislators. As individuals and as members of professional groups, we each have an obligation and a duty to perform.

Last year, the NSTA sponsored the Science High School Act and supported the compromise bill for a National Science Foundation. This year, we are concentrating all of our legislative effort in behalf of the National Science Foundation. We believe that the time is both ripe for and favorable to its success. An Inter-Society Committee in support of this legislation has been organized and NSTA is represented in the Committee. Two bills have been introduced in the Senate and their counterparts in the House. They are S-525 and S-526. Differences between the bills will most certainly be resolved.

Should S-525 or S-526 become the law of the land, every science classroom will be affected. A National Science Foundation would have a tonal effect upon science teaching everywhere. The twelve-year program, long recommended, but never realized, would come nearer to reality. An adequate science teacher training program, better equipment and more laboratories would be sure to follow. The hunger for more "time for science instruction" would be better satisfied. Government scholarships and fellowships to science talented youth, selected solely on the basis of aptitude, would quickly identify the work of science teachers with the future of our own country and of world destiny.

IN ORDER that we may work together in this good cause and so that our effort can gain strength from contact with the seventy or more groups in the Inter-Society Committee, we invite your individual and group support of the NSTA program.

1. Write to your Congressman and Senator, urging the establishment of a National Science Foundation.

2. Pass Resolutions in your local professional groups in behalf of a National Science Foundation.

3. Send us a copy, so that we may transmit it to the proper person and at the right time.

Time For Science Instruction

In which the cause of science in the schools is well presented

DWIGHT E. SOLLBERGER,
Editor
*State Teachers College,
Indiana, Pennsylvania*

THE NATIONAL Science Teachers Association wishes to call the attention of science teachers, administrators, and others interested in science education to the 1946 Yearbook entitled "Time for Science Instruction." The purpose of the Yearbook is to highlight the time problems which confront the science teacher in this period of stress in our educational system. Every science teacher is aware of the "time problem" as he endeavors with might and main to secure time for laboratory work, time to find suitable equipment at reasonable prices, time to get the equipment ready for class use, time to repair equipment, time to put it away, time to correct laboratory notebooks, time to prepare lecture demonstrations, time to discover and nurture scientific talent, time to attend meetings to keep abreast of a fast-moving field, and time to be a good citizen in his community. Your Yearbook editor, Yearbook committee, and officers of the organization invite your comments.

Science educators are concerned more than ever before with the quality of science instruction. The social implications have made the science educator aware of his tremendous responsibility in presenting the subject properly to the youth of the land. Although it was implicit in the scientific method, that that day would arrive when man's destructive powers would enable him to destroy civilization as well as to build a better civilization, it was not until the closing days of World War II that this truism really struck home. Certainly there is no further excuse not to see the dual aspect of science and to properly instruct our youth in its use.

"Time" to properly instruct all youth *must* be found. As Dr. Morris Meister, President of the National Science Teachers Association, states in the 1946 Yearbook (page 2), "Time conditions every classroom, every child, and every bit of science teaching, regardless of curriculum, philosophy, method, or text."

OUR COLLEAGUES in other fields may smile at us indulgently, view us with alarm, anger, or contempt when we say that more "time" must be found for better science instruction, but as Dr. George Hunter, (page 46) states in his article, "They seem to forget that for the best teaching of science, ample demonstrations are necessary. Such demonstrations take not minutes, but hours of preparation. One cannot take them out of a hat like a magician's rabbit. It is little wonder that the overloaded science teacher shifts emphasis from the inductive method of demonstration and the laboratory to the easier use of textbook and quiz."

As one reads the Yearbook, one becomes aware of the fact that the problems are widespread. Who has not sensed what Brandwein (page 23) expresses when he says, ". . . this is a time for action if we are to make science as important to our students as it is in their lives," or when he raises the question as to why our students do not "insist on taking science courses." Who has not felt what Perino (page 39) states so well when he says, "Ultimately, however, the teacher adapts his teaching procedures to his class load and other tasks, and the community gets what it pays for." What science teacher does not know what Thelen (page 38) means when he writes, "Allowing a teacher one and one-half hours credit for a three-hour laboratory period, for example, implies that the activity unfolds itself with no help from the teacher and that in effect the teacher might just as well work hard for an hour and a half and find a soft corner to sleep in for the other hour and a half or that the teacher will be expected to operate at one-half efficiency during the three hours."

However, science teachers must not err in believing that they cannot improve the use of their time. A careful study of Cahoon's article (page 26), *Using Time Effectively in Science Teaching*, will reveal many labor-saving devices which will result in better use of the time that is available.

For Better Science Texts

M. VAN WAYNEN
Instructor, Berkeley High School, Berkeley, California

Do you agree with Mr. Van Waynen as to science texts? If this arouses any reaction, we would appreciate hearing from you.—Editor.

THERE is nothing quite like a highly intelligent class blessed with the usual inquisitiveness of youth to awaken a teacher to the fact that the various branches of physics not only encompass an immense amount of knowledge but also that this knowledge is expanding so rapidly that the average teacher with her usual over-supply of responsibilities can hope to assimilate only a small part of it. If high school pupils did not believe so implicitly in the infallibility of their teacher's erudition, the situation could be a bearable one. Under the circumstances how many of us (and we need not be martyrs to admit it) have been driven to the point where we answer what questions we can and tactfully gloss over the rest with perhaps undue subterfuge?

No instructor should be censured for not knowing as much as his pupils seem to think he should. All pupils must become disillusioned sooner or later. Discovering that the teacher is but a poor substitute for an encyclopedia and all of the information that is constantly being published in scientific periodicals and books may be temporarily disconcerting, but certainly not disastrously so. A teacher should, however, be censured severely if she places too much faith in the validity of the information she imparts from supposedly trustworthy sources, sources not usually suspected of harboring implied if not always real errors.

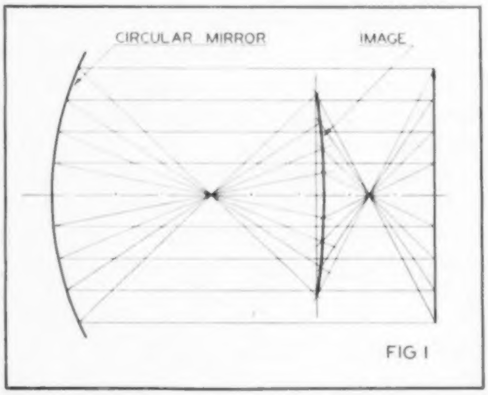
If the average high school text book can be accepted as an example of today's pattern of teaching physics, then the teacher of physics had better look to her laurels. The basis for such an accusation may not be immediately apparent since the errors spoken of here are subtle ones not intentionally made. Due to the rapid evolution of science these errors might be held to be excusable. However, since most of them have crept in because zealous authors have not wisely written down college texts for high school consumption, their existence can no longer be justified.

ONE TYPE of fallacious teaching occurs when we unwittingly lead our pupils to accept facts they were never intended to accept, but which by implication they had to accept because the whole story was not or could not be told. Such errors are numerous. A simple situation of this type arose in a discussion involving the divisions of the atmosphere. One book states,

"Up to an altitude of about seven miles extends the layer called the troposphere . . . Above this is the stratosphere, where the temperature remains constant (about -55°C) and where there are neither water vapor, clouds . . ."

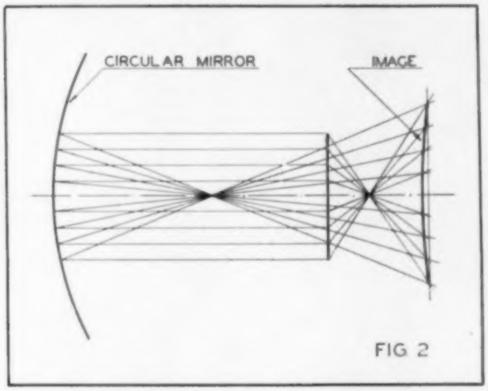
According to this statement, *the only one in this particular text**, could not one conclude that the stratosphere extends to the outer limits of the atmosphere even though the text itself does not say so? By implication is not this conclusion the one that would be deduced by a pupil with no more information available?

For a more complicated example, that incidentally also involves carelessness in the defining of key words, consider the impression a pupil must derive from the text about the relationship between the loudness of a sound and the amplitude of vibration. To begin with, the distinction between the words "intensity"



In figure 1 note that the image of the arrow produced by a circular mirror is not a straight line, but slightly curved.

*The illustrations used in this article are taken from several books and are not necessarily common to all.



In figure 2 above the image is also curved when formed at a greater distance from the circular mirror.

and "loudness" is usually not made. The two words are hopelessly confused and invariably end up with a meaning akin to that for "loudness." (When we recall that "intensity" technically refers to the rate of transfer of energy across a unit area perpendicular to the direction of propagation of the sound wave, while "loudness" refers to the magnitude of sensation, why do texts use the word "loudness" at all. Physics is not supposed to deal with the subjective aspect of sound waves.) Still one text states on one page that

"the loudness of sound depends on the amplitude of vibration of the waves" (intensity),

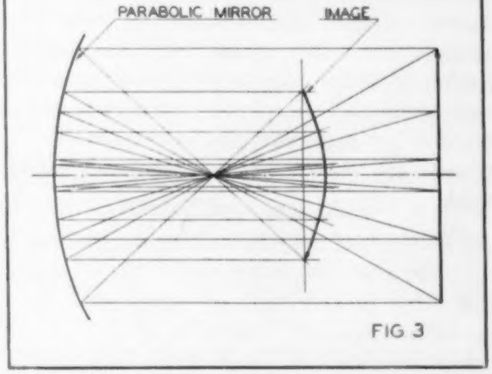
while by way of emphasis on another page it states that

"the loudness of sound depends upon the power delivered to the ear drums" (intensity). Even though no attempt has been made to distinguish between "intensity" and "loudness" previously, now the words seem to be used in their defined sense. The damage done so far, due to the lax use of terminology, although serious enough, might be forgiven because the pupil still may retain a reasonably accurate impression of the relationship between "loudness" and "intensity" as stated by the author. However, real damage, unforgivable damage, has been done, unintentionally again, because no mention is made of the fact that "loudness" does not depend *only* on "intensity." True, the text does no tsay that "loudness" depends *only* on "intensity," but in mentioning only one of the variables has the text not implied it? To what other conclusion can the pupil come? By omitting the whole story more permanent harm than good has been done. The pupil, unless he goes on to college physics, will never learn that "loudness" also depends on the sensitivity of the ear and the frequency of the sound wave that is heard.

Images formed by concave and convex mirrors and lenses should also come in for careful scrutiny. Invariably objects are simply represented by arrows and their images by longer or shorter arrows, nearer to or farther from the reflecting surface, *but always just as straight as the original arrow.* Since we ascribe to the spherical concave mirror of small aperture the properties of the parabolic mirror, and thus assume the incident rays parallel to the principal axis reflect through the focal point of the concave mirror, should the image be straight? Do not images formed by spherical mirrors appear curved? Is the image formed by a parabolic mirror straight? A pupil more discerning than some investigated the problem, producing the following three drawings which show that the images should not be straight.

SOME MAY argue that to ferret out errors of this sort is trivial. The author's intention was to show how the images were formed, emphasis being placed on the position of the image and its size relative to the position and the size of the object, not on the actual shape of the image. Was it necessary then to draw straight arrow images? What harm would have resulted by drawing the actual image? Pictures imprint themselves vividly on our

Continued on Page 92



In figure 3 the image formed by the use of a parabolic mirror is not a straight line as might be expected, but is distinctly curved.

Are You Planning a School Garden?

Here Are Some Ways to Insure It's Success

PAUL R. YOUNG
Board of Education,
Cleveland, Ohio

PAUL R. YOUNG

The editor of our garden section, Mr. Paul R. Young, is a director in the National Science Teachers Association and nominal head of its garden section. He is a member of the Advisory Board of the American Horticultural Council, and chairman of School Garden Committee, Men's Garden Clubs of America.

Mr. Young has a broad background of experience in agricultural and gardening education. He taught agriculture in New York state, 1916-20; and served as assistant state 4-H leader, New York State College of Agriculture at Cornell University, 1920-26. Since 1926 he has served as School Garden Supervisor, Cleveland Board of Education. Under his direction the school garden program of Cleveland has won national recognition for its outstanding achievements.

He is author of *Elementary Garden-Graphs* and *Advanced Garden-Graphs*, simple texts in gardening for elementary and junior high school pupils. He has also written numerous articles on school gardening in various educational and horticultural periodicals. Since 1935 he has been Garden Editor for the Cleveland News.

If you have any material for publication in this area, we urge you to send it to Mr. Young for consideration.

SUCCESSFUL school gardens involve so many details of equipment, management and operation, that the novice can hardly be expected to foresee them all. The following suggestions, based on long experience, are offered in the hope that they may be of use to some who are confronted with the responsibility of managing a school garden tract.

To successfully conduct a school garden consisting of individual plots, there must be a capable person in charge, someone who has initiative, managerial ability, and a knowledge of how to work with children. This person must also be familiar with garden practice and theory, or have expert advice always available. A good teacher, with practical experience or training in gardening, is most likely to meet these requirements.

Some labor, either paid or voluntary, will be needed for work the children cannot do.

The Land

If there is any choice, pick a well-drained area with reasonably light soil for maximum ease in working it. Use only land of at least average fertility. Apply all the manure or peat-humus available to increase the organic matter content, and fertilize with 20 to 30 pounds per 1,000 square feet of a standard garden fertilizer such as a 4-8-4 analysis. Plow and fit the soil thoroughly, turning under the manure or peat, and harrowing in the fertilizer. Do this as early as the soil is fit to work.

Equipment and Supplies

The need of a fence will be determined by the nature of the community. Snow fencing will serve quite effectively when only casual vandalism exists.

For the children 5-inch-blade hoes and 10-tooth rakes are best. Get enough to provide one for each pupil in the largest group that will be working in the garden *at one time.* Number them, and assign tools to pupils by number, to make checking easy. A dozen or two trowels and a few miscellaneous shovels, spades, grubbing hoes, etc., are desirable. A sprayer or duster and insecticides adequate

The real school garden crop is happy, healthy, intelligent youngsters. Harvey Rice School Garden, Cleveland.

for the area as a whole should be available, as well as some sort of watering equipment.

Stakes 1″ x 1″ x 18″ will be needed for marking off the plots, and others 1″ x 2½″ x 30″ for putting each youngster's name on his plot. Staking of tomatoes with stakes 1¼ inches square, or larger, and 6 feet long, is highly desirable.

Seeds can be purchased in bulk and packeted in envelopes of appropriate size by the children, as a pre-season activity indoors. Plants may well be purchased from commercial growers, especially when the project is newly organized.

When the gardens get to this stage the gardeners' enthusiasm is really high. Sixth grade gardens at Benjamin Franklin School Garden, Cleveland.

Layout

With tape line and twine lay out the area according to plans previously worked out on paper. Adjust the size of plots to the available area and the number of pupils. Plots of from 120 to 300 square feet for elementary children, and up to 500 or 600 square feet for junior high pupils, work out well. Arrange the plots in rows fronting on 3 or 4-foot main paths and with backs adjoining, just as city lots are laid out. Narrow paths separating the plots in each row are desirable to give the youngsters opportunity to get around their plots without trampling on the crops.

Uniform plot plans for pupils in a given group are essential to effective group instruction and work. If possible have the children study the plan carefully before actual gardening begins. Have charts showing the plan to be used always available for reference by the boys and girls.

Enrollment

ENROLLMENT for a plot on a school garden tract should be voluntary and a definite privilege. An enrollment fee of from 35 to 75 cents will be found a psychological advantage. It keeps out triflers and represents an investment that the youngster tries to protect. The money received can be used to purchase seeds and other supplies, and to provide modest prizes in the fall. Continued on Page 68

A Projection-Type Galvanometer*

RALPH H. HALL
Graduate Student,
Ohio State University

WILLIAM F. GOINS, JR.
Instructor of Chemistry,
Hampton Institute, Virginia

THE NECESSITY for making classroom demonstrations equally visible to all members of the class offers one of the most recurrent of difficulties. Means which have been suggested for overcoming this difficulty are (1) to move the demonstration from row to row, repeating it as necessary, (2) to use large size apparatus, and (3) to project an enlarged image of the apparatus. For demonstrations involving the use of a galvanometer the third procedure seemed most feasible. It was decided to develop a projection-type galvanometer with sufficient sensitivity to be useful with certain electrical demonstrations which are commonly performed in physical science classes.

The purpose of this project was the construction of a simple fixed coil galvanometer which would fit the ordinary lantern slide projector in the place of the slide carrier, and which would project the shadow of the movable needle on a suitable screen, thus causing deflections of the needle to be equally visible to all pupils in the class.

Construction Details

Materials: (Refer to Figure I)

50 ft. No. 24 to 30 enameled or D.C.C. copper wire.

Wood for construction of frame (5¼" x 4¼" x ⅝")

2 pcs. Glass 4¼" x 5¼"

Sheet aluminum

*This project grew out of experiences in the Laboratory Practicum for Science Teachers course at the Ohio State University under the direction of Dr. G. P. Cahoon.

PLANNING A SCHOOL GARDEN

Continued from Page 61

A prepared enrollment form to be signed by the youngster and by the parent to indicate home cooperation, is advisable. Enrollments should be completed before actual work begins, with no refunds of fees after that time. A waiting list of would-be enrollees who cannot be accommodated is a real stimulus to good work on the part of those accepted.

Planting

Prior to planting time some instruction about the crops to be grown, planting methods, soil preparation, etc., should be given. As soon as the soil is ready, planting should proceed, keeping pace with the season as closely as possible. Whenever possible it should be done in school time, as practical science. Whole classes can participate if the pupils who are not enrolled for garden are assigned as helpers for those having plots. If absolutely necessary, planting can be done after school and on Saturdays. Children seldom object to such fascinating activity.

Pupils in each class are assigned adjoining plots in one or more rows. Long planting lines can then be stretched, covering all the plots in a given row. After a demonstration by the teacher, each youngster goes to his own plot and plants the row in question. Then the line is moved to the next row and the process repeated.

Summer Program

BEFORE school is out in spring, assign each pupil gardener to a definite schedule of group meetings for the summer vacation. Two weekly work periods, aggregating 2 to 2½ hours, should be enough. Not over 30 to 40 pupils should be handled by one teacher at a time; 25 is a better number. Summer classes should be made up of children having adjacent plots in order to keep the activities of any one period localized. One morning and one afternoon period each week for each pupil works out well.

Definite jobs to be done during the week should be posted each Monday, where all gardeners can see them. Absentees should be checked by telephone, postal card, or a home visit. A system of weekly garden grading, based upon attendance as well as garden work

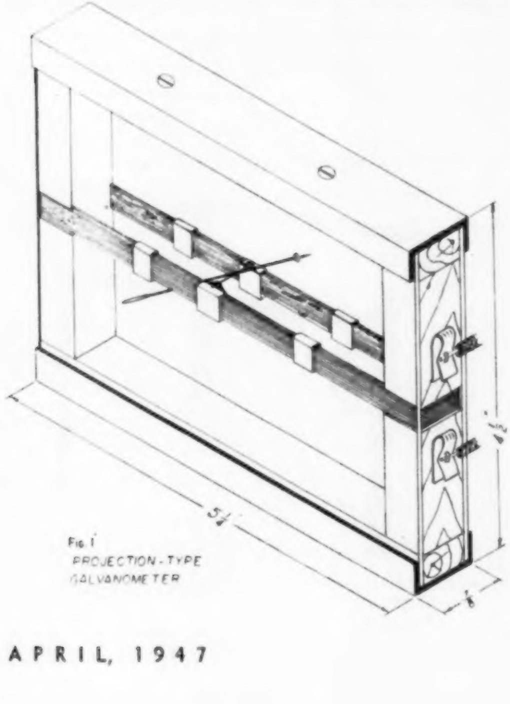
Continued on Page 100

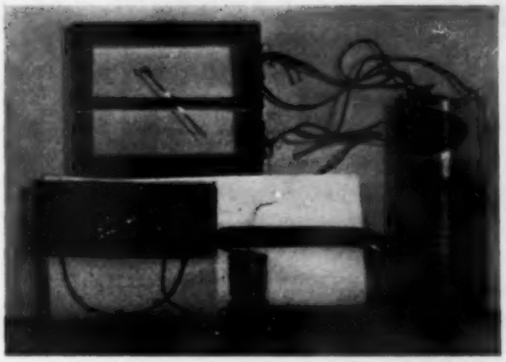
1 Darning needle, large $2\frac{1}{2}''$ or $3''$
2 Fahnestock clips or other binding posts
Airplane cement
Wood screws, brass

The end members of the frame are recessed in order that the coil consisting of 50 turns of No. 24 insulated copper wire may be wound so as to be flush with the inner surface of the glass plates. Larger diameter wire limits the number of turns on the coil while smaller diameter wire increases resistance, either of which will affect the sensitivity of the instrument. After the coil was put in place, scotch tape was used to bundle the coil sides. A tiny bead may be centered on each side of the coil, but a piece of sheet aluminum with a small hole punched in the center will work just as well for the indicator spindle bearing. Airplane cement holds the bead or sheet metal in place, once you are certain of proper alignment.

THE POINTER is a large steel darning needle which has been magnetized by placing it in a coil of a few hundred turns of wire through which a direct current of three to five amperes is passed for a few minutes or by stroking it with a strong permanent magnet. The spindle was made of a short piece

In the drawing below note the arrangement of the turns of wire and the steel darning needle. used as a pointer.




The projection-type galvanometer as designed in the laboratory.

of No. 24 copper wire which was attached to the center of the needle with airplane cement. A counter weight of copper wire was wrapped and cemented to the end of the needle for final balancing. Small beads or short lengths of glass tubing drawn into a capillary may be placed on this spindle for "stand-off." These will keep the needle properly centered. However, if the spindle is carefully cut to length, the glass face plates will make the "stand-offs" unnecessary.

The glass plates were put on when the entire block, coil, and pointer had been completed and assembled. Sheet metal channels were formed to hold the glass in place. They can be made of sheet metal taken from a tin can, although a nonmagnetic material such as aluminum is desirable. The glass can be pulled out easily for adjustments to the meter, and to enable a scale to be marked on one side of one of the glass plates.

In use, the instrument described throws a clear-cut shadow of the needle, coil, and scale on the screen. It is sensitive enough to show a marked deflection of the needle by a current generated in a coil of wire when a magnet is passed in and out of the coil. A dry cell when connected first one way, then the other, shows the opposing polarity of a current-bearing coil when the direction of current is reversed. The instrument is not sensitive to a thermocouple but motion of the needle can be detected when the galvanometer is attached to a "lemon" cell or a voltaic pile. It can be used as any normal galvanometer with the limitations of extreme sensitivity.

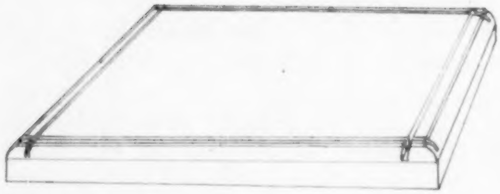
An Adaptable Display Case

ENID A. LARSON
*Oroville Union High School,
Oroville, California*

During the school year 1945-1946 our Advanced Biology class prepared a series of class demonstration models. These models were of a quality that proved to be of more than temporary usefulness. Since they were somewhat fragile, the need arose for some permanent display housing. One of the students of the class volunteered to design and construct such a case.

This case, as designed and constructed by David Woods, who was a junior-year student, is inexpensive, easy to assemble, and may be made out of scrap material which can be found in any high school shop. The resulting case is aesthetically pleasing as well as being a most useful addition to classroom equipment. The dimensons can be varied to meet the need of the material to be housed.

THE CASES which we have constructed are of the following dimensions: (1) base—9″ x 11″ with the glass measuring 8″ x 10″ x 6″ and (2) base—11″ x 19″ with glass 10″ x 18″ x 9¾″. The materials used for construction were: surfaced pine, (three-quarters of an inch in thickness), window glass, and black Passe Partout tape. The wood base was cut to dimension and then grooved to a depth of ⅛″, one-half inch from the edge. The wood was sanded, given two coats of clear shellac, and then one coat of clear varnish. The glass was cut to measurement, fitted into the grooves in the base and the edges joined with Passe Partout tape. The model was glued firmly in position on the base, and, finally, the top piece of glass fitted and taped in place. With care the assembled glass housing may be removed in its entirety without damage to the joining. This allows for cleaning and polishing the glass or changing the model. The accompanying diagram[1] gives the design of the base. The photograph shows the assembled case.



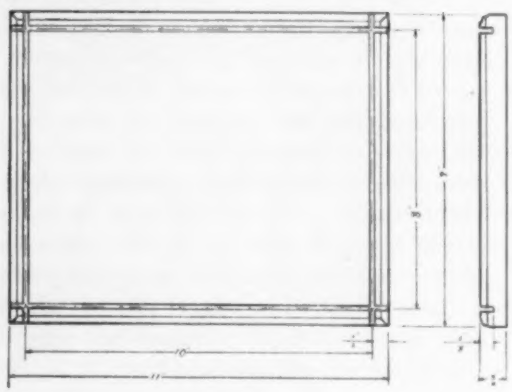
The base of the display case as seen from a side view.

WE HAVE constructed seven such cases. The total cost for materials for one such case measuring 9″ x 11″ was sixty-five cents. The cost of the materials for the 11″ x 19″ case was $1.15. The student's time involved in actual construction was approximately ten hours for the seven cases. An estimate for

1—Illustrations prepared by members of the Biology class: Line drawing by Frank Croghan; photograph by David Woods.

Continued on Page 86

The detail of the base is shown indicating the position and depth of grooves.



The frame set into the grooves holds the glass sides in place.

Place of Science in the Education of the Consumer*

NATHAN A. NEAL
Board of Education,
Cleveland, Ohio

What Consumer Education Is Needed?

CONSUMER education must help the young consumer to be a more intelligent, a more effective, and a more conscientious member of the economy in which he lives. He needs to be intelligent in developing a fine set of values to guide his actions; in using his resources of time, energy, money, and capital goods; in finding and using reliable sources of information; in applying the findings of research to his consumer activities; and in understanding the operation of our system of production and distribution and the basic economic principles upon which it rests. He must be effective in the ordinary skills which make for competency in purchasing and using goods and services for himself and his family; and in working in an organized fashion for desirable reforms. Finally, he must develop such attitudes as will lead him to put his beliefs into practice; to work for the common good and for what is best in the long run, rather than for immediate and selfish gain; to avoid exploitation, whether of businessmen, workingmen, farmers, or of his fellow-consumers; to study thoughtfully what government should do and to back his decisions with action; and to work for conservation of material and human resources.

Major Contributions to be Emphasized

There are at least four major contributions which science teachers can make:

1. To help students to use science in making wiser decisions about purchases. Science should make a positive contribution to the development of an intelligent sense of values as a basis for determining allocation of expenditures. With respect to actual over-the-counter purchasing, science can help make analyses and comparisons of such factors as usefulness, as in drug store vitamins; lasting time, as in an electric motor or a bed sheet; health values, as in a drug; safety, as in an insecticide. Science can contribute to the recognition of degrees of quality through the measurement of gas, water, and electricity used in the home; sizes of containers; weights of bananas, oranges, eggs, ice cream, as compared with dozens or volume.

2. To help students to employ science in the effective use or operation of goods and services. The wise purchase of an automobile is important, but not so important as its effective and safe use over a period of years. Science can contribute to a student's effective use of what he has already acquired. It can also teach him to apply numerous scientific principles to the preservation and preparation of foods, to the care and maintenance of clothing, and to the management of his home. It is not merely that the student will learn to operate his apppliances more cheaply, and to keep repair and service bills low—although these savings may be important—but also that he will get maximum use and satisfaction from the things he owns.

3. To help students to use science in improving their own production for home use. Although, in this industrial era, production has largely been taken out of the home to the factory, the production of goods and services for oneself and one's family is still an important means of adding to real income. Science can contribute to improved production through wider use of more productive varieties of plants and animals, such as hybrid corn and pure-bred cows; through soil maintenance and improvement; through the conversion of wastes into useful materials. Scientific tests aid in determining and improving quality. Scientific storage and preservation enable the small producer to keep temporary surpluses for later use.

4. To aid pupils in the wider applications of the methods of science to the solving of consumer problems. Consumer problems offer excellent opportunity for the use of critical thinking. Emphasis may be given to the use of experimental bases for conclusions. Experimental tests of consumer goods provide opportunities for realistic application of scientific techniques. Also, honest, thoughtful work

*An excerpt from a summary of points of view expressed by the NSTA committee on "The Place of Science in the Education of the Consumer."

on consumer problems provides opportunity to develop the scientist's love for truth.

Criteria for Selection of Subject Matter

1. Science education aimed at consumer values should emphasize those goods and services which account for a high proportion of consumer expenditures.

2. Science education aimed at consumer values should give attention to those commodities which are of outstanding importance or which present special difficulties to the purchaser, even if the total sum spent on them is not great.

3. Science education aimed at consumer values should give attention to any goods or services the purchase or provision of which is —or seems—highly and immediately immediately important to the students.

4. Science education aimed at consumer values should emphasize those phases of consumer education which the science department is especially or uniquely able to present.

Natural Resources

AMONG the major consumer problems which are directly related to the usual content of science education none stands out more clearly than that of maintaining, improving, and utilizing wisely our soil and other natural resources. For the continued high-level satisfaction of consumer wants depends upon the continued capacity to produce abundantly and at low cost.

Waste and poor use of our soil resources and the connected lack of attention to water management have received much attention in recent years. Some progress has been made, but the responsibilities of science education in this direction are still great. A relatively small number of our soil users are as yet employing suitable conservation practices. Here, again, the possible increase in production and in the economy of production are great if soil conditions and fertility are developed to the maximum.

Consumer Use of Sources of Information

ONE OF THE most profitable lines of activity in consumer education is that which teaches the young consumer to be alert, to use many sources of guidance and information, and to use them with an intelligent skepticism. This objective of consumer education corresponds closely to one major goal of science education —to bring students to use a wide variety of sources of information, but to exercise a keen critical judgment. Work along this line may be the most valuable single tie-up between science and consumer education.

Much of the information a consumer needs comes to him in informal fashion through conversation with others of experience, through the advice secured from sales persons and advertisements, and through personal experience. Such information, like that from any other source, needs the test of critical evaluation. In addition, the consumer who cares to make more effort will find organized agencies of information at his command.

Some government agencies are valuable sources of information for consumers. Private testing and rating agencies are valuable sources of information. Some professional associations are valuable sources of consumer information. A variety of other sources of consumer information is available.

Curriculum Organization

Four general arrangements are possible for extending the use of science in consumer education in secondary schools:

1. Biology, physics, chemistry, and other established courses of the secondary school may be given a definite consumer education slant.

2. A course labeled consumer education or science in consumer education may be established as a part of the work of the science department.

3. A separate unit on consumer education may be made a part of each of the major courses in science.

4. Consumer education may be one of several large areas about which the work of a considerable part of the school program may be integrated.

OF THESE four general arrangements the committee strongly favors the first, in which science teachers in their regular work give increased attention to the problems of consumers. It is realized that any increase in the time and attention given to consumer problems may mean a corresponding reduction in the time and attention given to other kinds of work.

This and That

NORMAN R. D. JONES

Vice-President and Membership Chairman

Miss Greta Oppe, Head of the Science Department of the Ball High School, Galveston, Texas and regional vice-president of N.S.T.A., has been asked by the State Department of Education of South Carolina to review its recent publication, "Suggestions for the Teaching of Science in the Twelve Year Program," in the Science Teacher.

The Dick Weavers are now located at Chapel Hill, North Carolina (Box 1078) having resigned his work at the Audubon Center at Greenwich to take over work at the University of North Carolina and the State Department of Public Instruction.

Pierre A. Rigaud of Port-au-Price, Hati, who has been a member for several years, recently received recognition for his work in pharmacy.

Mr. Marion U. Greer, Oklahoma State Director, was re-elected science section chairman of the Oklahoma Education Association for the 1947-8 school year.

Mrs. Marian Nelson, Oklahoma City Area Director, is chairman of the committee to form the constitution for the formation of the Oklahoma Science Teachers Association and plan for the inclusion of affiliation with N.S.T.A. Mrs. Nelson spoke on "The Roll of Organization," with N.S.T.A. plans as a background at the recent meeting.

Mrs. Audrey Hill Lindsay of Southern Illinois Normal University High School is now teaching at the University High School of the University of Illinois at Urbana.

Mr. I. B. Ball of Berkeley, California, recently retired from teaching and recommended his successor for N.S.T.A. membership.

Mr. Joseph W. Shapiro, Tennessee Director and president of the Tennessee Science Teachers Association reported a fine meeting, March 27 and 28, 1947, at which affiliation with N.S.T.A. was voted.

Mrs. Myrtie O'Sheen Baker, Atlantic Georgia Area Director and secretary of the Fifth (Georgia) District Science Division, also reported a fine meeting the last of March. The Georgia state science meeting will be held April 25 and 26.

The Southern California Science Teachers Association's annual spring meeting on April 5th featured an especially conducted tour through the "Cooperative Wind Tunnel."

Change of Address—Service

Will you please notify us of your change of address. It is only as we learn of them that you will get your fall publications of the Association. Also, please inform us when you do not receive your publications. It is only as you let us know that we learn of such omissions. Please wait, however, until at least the 15th of the month following publication date as there are unavoidable delays. We are still trying to locate the addresses of undelivered magazines and yearbooks to our 1945-46 members who did not notify us of changes.

New Zealand

A word of greetings from N.S.T.A. is extended to the Wellington Science Teachers Association and the Wellington Branch of the New Zealand Institute of Chemistry through Mr. Sydney J. Lambourne, who is chairman of each organization.

Cincinnati N.E.A. Meeting

Our summer meeting held in conjunction with the National Education Association, which is again a "limited" meeting, will be held Monday, July 7, morning and afternoon in Cincinnati, Ohio. A fine program is being prepared by Mr. Nathan A. Neal. All living within that area are urged to attend. Others are urged to contact their local, district or state N.E.A. organizations to secure an appointment as a delegate to the N.E.A. Representative Assembly, then come early enough for this meeting.

Pacific Division A.A.A.S. Meeting

The Pacific Division Meeting of the American Association for the Advancement of Science will be held in San Diego, California, the third week in June. The Southern California Science Teachers Association, an affiliate of N.S.T.A., will be the host organization sponsoring the N.S.T.A. meeting. The central committee for this meeting is Marion U. Taggart,

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Science Clubs at Work

Edited by MARGARET E. PATTERSON
Secretary, Science Clubs of America

• A department devoted to the recognition of the splendid work being done by science club members and their sponsors. Material for this department, such as student made projects; demonstrations and posters; outstanding club programs; state and regional meeting announcements; should be sent to Miss Patterson, Science Clubs of America, 1719 N Street, N. W., Washington 6, D. C.

Teen Age Scientists

DR. GRANK THONE
Science Service Staff Writer

FORTY high school seniors—nine girls, thirty-one boys—were in Washington, D. C. February 28 through March 4, for the Institute of the Sixth Annual Science Talent Search, conducted by Science Clubs of America, administered by Science Service, and made financially possible by the Westinghouse Educational Foundation.

At the concluding banquet two grand science scholarships of $2,400 each were awarded: one to Vera Radoslava Demerec, 16, of Cold Spring Harbor, N. Y.; the other to Martin Karplus, 16, of Newtonville, Mass. Eight scholarships of $400 each were awarded, and thirty winnners received $100 scholarships.

Herman Bieber, Jr. 16, Erasmus Hall High School, Brooklyn displaying a self-designed power supply for home laboratory. His essay was about ornithology. He was winner of a $400 Westinghouse Science Scholarship in the Sixth Annual Science Talent Search. Courtesy of Acme.

These forty young people, who were brought to Washinngton from all parts of the country represent the final sifting from an initial field of more than sixteen thousand candidates who competed. First sifting consisted in the grading of the examinations, scholastic records and teacher recommendations. This selected out the top three hundred for the next stage based to a considerable extent upon the estimate of essays on "My Scientific Project." Three judges read and graded them independently of each other, and then collated their findings.

Forty winners were named to make the trip to Washington for final ratings, based largely on personal interviews with four judges. The remaining 260 contestants make up an Honorable Mentions list, also much sought after by colleges and universities as possible candidates for scholarships.

Although a majority of the forty winners come from schools in the northern part of the eastern seaboard, where population is most heavily concentrated, all sections of the United States are represented, with secondary concentrations in the Mid-west and on the Pacific coast. Also, small high schools with inspiring teachers have competed successfully with large, elaborately equipped high schools.

Validity of the Science Talent Search method of selecting promising young people for research careers in science is well attested by the records of participants in previous contests. Of those in the first two, most have now completed their undergraduate work, and some are now well started in their graduate studies. Graduate and technical schools have

Walter Barclay Kamb, 15, Pasadena Junior College, California, illustrates the formation of potholes with a device he designed to explain his theories for the origin of these geological formations. Courtesy of Acme.

in general been liberal with fellowship aid to these students. This may be partly a reflection of the early maturing of purpose in the young men and women who participate in the Science Talent Searches: almost all of them have their minds made up, as high school seniors, about the careers they wish to follow, and also have selected the institutions which they wish to attend.

Participation in scientific activities such as science fairs, science conferences, Junior Academies of Science, etc., is rather common among these students; it may be regarded as another evidence of their enthusiasm for science, but it also undoubtedly helps to condition them for the parts they take in the Science Talent Search.

The widespread notice which the six successful nation-wide Science Talent Searches has attracted has stimulated the organization of State Science Talent Searches, sponsored usually by state academies of science working with Science Clubs of America. Pioneers in this movement were Virginia and Tennessee, which held their first state Searches in 1946. This year they have been joined by eight more states that plan such an activity: Alabama, Georgia, Illinois, Indiana, Iowa, Louisiana, Mississippi and South Carolina.

Following are a few brief accounts, written in news-story style, giving the highlights of the essays submitted in partial satisfaction of the requirements of the Sixth Annual Science Talent Search.

COLOR MUTATIONS

NEW COLOR types cropping up among her hybrid fruit-flies did not bother Rada Demerec, 16-year-old senior at Huntington N. Y. High School. She figured out what must have happened to their chromosomes during the critical cell-division when the appearance of the future organism is being determined.

Miss Demerec had crossed ordinary wild-type fruit-flies with yellow-white ones. Theoretically, the first-generation offspring should have been half like one parent, half like the other. However, among about 2000 of such "orthodox" descendants, there appeared 15 white and 14 yellow flies.

This, the unperturbed young geneticist explained in her Science Talent Search essay, was due simply to chromosomal crossing-over. That is, a pair of chromosomes carrying the genes for yellow and white color got twisted partly around each other, and when the final separation into new nuclei came, a bit of chromotin was broken off each chromosome and transferred to the other, producing the unpredicted change in a few of the offspring.

Miss Demerec, awarded the Westinghouse Grand Science Scholarship of $2,400 for girls, started with a good background in her favorite study, for her father, Dr. M. Demerec, is head of the department of genetics in the Carnegie Institution of Washington, with laboratories in Cold Spring Harbor, N. Y.

BIRD MIGRATIONS

Some birds show a migration behavior suggesting that of some human communities in the past: they build up a greater population than the home territory can support, then burst out in a massive migration wave.

This population-pressure theory was offered as tentative explanation for the appearance of swarms of dovekies, small sea-birds of the auk family, far south of their normal winter range, by Martin Karplus, 16-year-old Newton High School, Newtonville, Mass. senior. The theory was put forward in an essay submitted in connection with the Sixth Annual Science Talent Search, in which he was awarded the

John Richard Hayes, 17, Clifton High School, Cliffside Park, N. J. demonstrates his home-made spectroscope made of scrap and make shift parts at a total cost of $4.00. Courtesy of Science Service.

boys top Westinghouse Grand Science Scholarship of $2,400.

More local movements of the dovekie, along with two other species of sea-birds of the same family, Brunnich's murre and the razor-billed auk, may be correlated with shifting of immense swarms of minute sea plants and animals, which are the ultimate source of food for these birds.

Food supply is again the answer to the riddle of the restricted range of a fourth sea-bird, the black guillemot, in Mr. Karplus' opinion. This species is found only in the neighborhood of rocky coasts primarily because the food it depends on is found only in such places.

This young ornithologist, whose work is already appearing regularly in scientific publications, will continue his ornithological work as his hobby but plans a medical career. Like Miss Demerec he is a product of America's melting pot. All four of their parents were born abroad and Martin himself came from Vienna only a few years ago. Karplus lists many scientists among his relatives—best known are Dr. Robert Frisch and Dr. Lise Meitner, both of whom made great contributions to our knowledge of atomic energy.

FOUR-DOLLAR SPECTROGRAPH

"If you haven't got it and can't buy it, make it!" is good Yankee advice well taken by John R. Hayes, 17, member of this year's graduating class at Clifton High School, Clifton, N. J.

He needed a spectrograph for some of his experiments in physics. Spectrographs are expensive. So he made one. In his own words:

"The spectrograph consists of an electric arc made from a ring-stand, laboratory clamps, and an old toaster; an adjustable slit made from a razor blade and parts of an Erector set; a collimator and a telescope, made from lenses set in iron pipe; a camera made from wood; and a discarded prism . . . Total cost was under $4."

Mr. Hayes also made a Wilson cloud chamber, a partial-vacuum device used in studying atomic disintegration of small amounts of radioactive matter. Materials for this were a discarded mirror, part of a rubber glove, a section of a bottle, a few pieces of wood, some bolts and a rubber washer. Total cost, 65 cents.

With these two pieces of home-made scientific apparatus, Hayes who plans to be a physicist, has been doing relatively advanced experimental work, such as is not usually attempted until the last couple of years in college.

INSECTS OF A COUNTY

THE HIGHLY varied insect life of a single county has been sampled by Donald M. Maynard of Nashville, Tenn., 17-year-old senior at the Peabody Demonstration School.

Mr. Maynard has collected species representing the insect life in Davidson County, Tenn., in which Nashville is located. Something over 300 species have been identified, distributed among 136 families, and representing all but three of the 26 orders, or major groups, into which insects are classified. By far the largest single group are the beetles; more than 120 of the 300-odd species belong

Donald More, Maynard, 17, of Peabody Demonstration School, Nashville, Tennessee displays part of his collection of insects gathered in Davidson County.

to this hard-shelled order. There are only a scant half-dozen species of ants.

Donald, who numbers many scientists among his relatives, plans a research career in biology.

URANIUM EXTRACTION

EXTRACTION of uranium from carnotite, an ore in which it exists mixed with vanadium, is reported by Donald D. Emrick, 17, of Waynesfield (Ohio) High School and Eugene F. Haugh, 17, of Reedsburg (Wis.) High School.

Mr. Emrick, using a sample of carnotite which was 86% sandstone, worked out a method of getting the metals in which he was interested into solution and then separating out, first the vanadium, next the uranium, and, in the residue, concentrating the radium and the radioactive lead.

Not so fortunate in his original method, Mr. Haugh applied his general knowledge of the principles of chemistry to try to work out for himself the way to get uranium and vanadium out of his sample of carnotite. He tried the methods given in the text-books for extracting from its ores the metal tungsten, supposedly uranium's next-of-kin.

Since the method worked for tungsten and did not work for the uranium ore, Mr. Haugh learned the hard way what only the leading nuclear chemists of the world could have told him—that uranium is wrongly placed in the chemists' table of elements, and is not the close relative of tungsten that it has long been believed to be. But Mr. Haugh worked over his samples again and again, and finally was able to produce a bit of photographic film spotted by the radioactivity of the sodium uranate he had extracted from the ore.

The two youthful chemists compared notes during the Science Talent Institute.

Leon N. Cooper, 16, Bronx High School of Science, New York City, exhibits processes and results of his study of penicillin - resistant germs. Courtesy of Science Service.

Audio-Visual Aids

EDITED BY CHARLES R. CRAKES

The editor of this department will attempt to bring before the readers of this publication the latest articles written by science teachers who are making effective use of various forms of audio-visual teaching materials. He will also endeavor to present a cross-section of educational opinions on audio-visual aids he may gather in travelling about North America.

THE ATTENTION of our readers is called to the following article written by Mr. D. F. Schutte, Director of Visual Education, Public Schools, Red Wing, Minnesota.

Mr. Schutte has gone to considerable effort in selecting a list of filmstrips suitable to be used in science study. The first list pertains primarily to biological aspects of science study. A later list will cover the field of physical science.

Mr. Schutte serves in a school system with an enrollment of about 2,000 students and eighty teachers on the staff. They use about 150 motion picture films per year, most of which are rented from the University of Minnesota. They already own a library of over 500 filmstrips. The school owns two sound motion picture projectors, eight filmstrip and 2 x 2 slide projectors, eight $3\frac{1}{4}$ x 4 slide projectors and one opaque projector. The library also includes several hundred $3\frac{1}{4}$ x 4 and 2 x 2 slides.

Their audio-visual aid budget for last year was about $1.00 per pupil.

The editor repeats his invitation to other science teachers throughout the nation to submit articles of about 1,400 words or less, on just how you are using audio-visual teaching materials.

He also urges that you send one or two glossy prints which depict students in some learning situation where audio-visual aids are being used.

C. R. CRAKES

Visualizing the Science Curriculum

D. F. SCHUTTE
Director of Visual Education, Public Schools, Red Wing, Minn.

SEEING is believing is an expression that we are all familiar with, yet in our enthusiasm we frequently spend an excessive amount of time talking about what we could show our students in much less time. We often hear teachers say that visual materials may be all right, but that they have so much work to cover that they just don't have time to use them. The answer is, of course, that all research studies made to date indicate that students learn more in less time and retain it longer, when visual materials are purposefully utilized in the instructional program, than when these materials are not used.

Visual materials make learning concrete by associating ideas with objects. Visual materials bring about more complete focusing of attention on the subject under consideration. Visual materials make learning interesting and an interested student learns faster.

Various types of visual materials can be used, for example, sound or silent moving pictures, filmstrips, slides, opaque projection materials, bulletin board displays, blackboards, models, etc. Filmstrips are among the simplest, and most economical of these aids to use. Filmstrips can be used to introduce, illustrate, or summarize a unit of work. In some ways filmstrips are superior to motion pictures, as class discussion may accompany the showing of the filmstrip, and they can be shown at any speed desired. An additional advantage is that the filmstrip projector is one of the easiest types of projectors to operate.

FILMSTRIPS in the classified list that follows are listed for various units. The same filmstrip may be listed under more than one

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How We Grew Up

A part of the journal's history is traced by the editor.

WE HAVE BEEN asked many times about the origin of The Science Teacher. Consequently we are presenting a little history of its beginning and growth. We find the matter of interest both to our advertising clientele and to many of our new acquaintances who appreciate the journal and its work.

The situation that called the journal into being developed in Illinois about fifteen years ago (1932) when funds were no longer made available for the publication of valuable papers presented before the Illinois Association of Chemistry Teachers at their annual meetings. We felt as did many others that something should be done. Already serving as editor of the News Letter of the association we decided to get advertising support for publishing the material in a journal. Credit for encouraging the plan goes to Mr. M. W. Welch of the W. M. Welch ScientificCompany and to Mr. E. M. Lamb of Lyons and Carnahan who immediately gave advertising support. These companies became advertisers in the journal that was begun in 1934 for association service, and it should be said to their credit that they have been in every issue from that time to the present. Other companies whose record of continuous support extend back almost to the first issue are the Central Scientific Company and the Chicago Apparatus Company.

THE JOURNAL was first named *The Illinois Chemistry Teacher*. However, the Illinois Biology Teachers Association also desired publication service; so the journal name was changed to *The Science Teacher* and this very active group also was served. Later the journal was adopted as the official publication of the Indiana High School Chemistry Teachers Association, The Texas Science Teachers Association, and the Iowa State Science Teachers Association.

IN THE support of each association we have endeavored to give help, not only in publicizing programs and publishing worthy papers of the group, but in stimulating membership growth. Many journals have been sent out without charge to prospective members upon the recommendation of association officers. The relationship with these associations has always been a most wholesome one.

In 1941 while attending the meeting of the American Science Teachers Association we found this national group in need of journal support and offered to share with them the service of the *Science Teacher*. Upon the recommendation of Dr. Harry A. Carpenter and Dr. Otis Caldwell, leaders of the organization, the offer was accepted and the journal became the official publication of this national group. With this national association as with state groups we set about promoting its growth and during the next two years when it held no national meetings its active paid membership was increased over fifty per cent.

In 1942 the journal was adopted by the Science Division of the National Education Association, later known as the American Council of Science Teachers. This group also needed the service of a journal to keep in close touch with science teachers nation wide. We are proud of the fact that the American Council also found the journal brought them many new members and an accelerated growth.

The plan followed in the support of national associations was simply to urge membership on the part of our subscribers and readers and to urge affiliation with the national associations on the part of state and regional groups whether we were already serving them or not. Many thousands of membership blanks were printed without cost to the associations and distributed along with our journal advertising. We found that many of our subscribers chose to receive the journal through association membership, which meant supplying the journal at cost or less[1]. Sometimes many copies of an issue had to be donated[2]. But we have always felt that the cause of the association should come first. The purpose of the journal was to serve. Profits were

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1—The American Council at first could only pay thirty-five cents per member for journal subscriptions.

2—The October issue for 1943 was donated to the American Council to help them change their journal year to begin in December rather than October.

News and Announcements

Name Announced

The materials formerly published by *The Science Teacher* are now being published under the name of *Science Publications* as will be noted in advertisements elsewhere in this journal. We take this opportunity to thank our many friends for the good suggestions sent in after our request for a company name in the previous issue. It will not be possible to thank each one individually.

The distribution of project books and other service materials under the name of *Science Publications* (Normal, Illinois) will serve to avoid confusion as to sponsorship and to distinguish them from those of the National Science Teachers Association. This is the purpose for which the new company has been established. The company will also serve as a sales agency for subscriptions to The Science Teacher among those who are not members of the associations that we serve.

Fellowship in Physical Science

Unusual study opportunities for 100 high school science teachers in 17 northeastern states under six-week all-expense General Electric Science Fellowships have been announced by Union College in Schenectady and the Case School of Applied Science in Cleveland.

The General Electric fellowship program has been carried on for two summers at Union College and will be inaugurated this year at the Case School. Each college will accommodate 50 fellows, equally divided between science teachers preferring to study chemistry and physics.

The special courses, designed to bring the fellows information concerning latest advances in chemistry and physics, will be conducted by the college faculties in cooperation with scientific staffs of the General Electric Company.

The third annual session at Union will be conducted from June 28 to August 9 and is open to teachers from New York, eastern Pennsylvania, New Jersey, Delaware and the New England States. Applications must be submitted before April 1 to the Secretary, Committee on General Electric Fellowships, Physics Laboratory, Union College, Schenectady 8, N. Y.

The Case session will be conducted from June 23 to August 1 for teachers from Ohio, West Virginia, Kentucky, Indiana, Illinois, Wisconsin, Michigan and western Pennsylvania. Applications should be submitted before April 15 to Dr. Elmer Hutchisson, Dean, Case School of Applied Science, Cleveland 6, Ohio.

Fellowships will cover traveling expenses, living expenses, and tuition at the sessions. Formal announcements and applications are being mailed to secondary schools and science teachers in the 17 states or may be secured by writing the college serving each area.

A New Spectrometer

A new type of spectrometer is announced by the W. M. Welch Manufacturing Company of Chicago. Its outstanding innovation is a pair of wave length scales, one for use with a grating and one for use with a prism, making it direct reading without need for any calculating from a formula and hence greatly speeding the determination of large numbers of spectral lines. A circular scale and vernier is also included for student use in measuring angle of prism, minimum deviation, etc. It is accurate within 20 Angstroms.

Embedding Biological Material in Unsaturated Polyester Resins

A process for the production of biological materials embedded in plastic has been developed by Ward's Natural Science Establishment of Rochester, New York, using an unsaturated polyester resin. After two years of experimenting it was found that "Selectron" produced by the Pittsburgh Plate Glass Company was the most satisfactory not only because of clarity but because it would lend itself to large scale production. Now they are able to embed soft and delicate forms such as embryonic specimens, jellyfish, flukes, etc., so they may be readily studied without damage in class.

NSTA and The High Cost of Living

EVERYTHING costs more; and NSTA has extended its services to members in new directions.

The great wonder to all has been, how NSTA could do so much for one dollar in annual dues:—Four issues of The Science Teacher, a Yearbook, Bulletins, Professional Meetings, Institutes, Projects, Reports, Legislation, etc., etc.

The tasks have not been easy. The accomplishments were made possible through the devotion and personal sacrifices of a relatively small number of loyal workers. Memberships this year have practically doubled. Activities and services have multiplied. Opportunities for even greater service to science teachers and teaching are at hand.

For example, Packet No. 1 of Science Information for Teachers has just been mailed. How about Packet No. 2, No. 3 and No. 4, etc? Shall this be a continuing service to members?

We have begun a Consultation Service to Industry. Shall this be developed?

We have established a headquarters for NSTA in Washington. Shall we now have a full-time executive secretary?

THIRTY affiliated science teachers groups all over the country have been asking for help. We have helped many of them. How can we serve them all and the many more who will soon wish to be affiliated with us? Unesco asks for our help. The AAAS and the NEA have assigned important tasks to NSTA. The National Association for Research in Science Teaching has voted to affiliate with us, and looks to NSTA for help in spreading the results of its research to the science classrooms of the nation.

In order to live up to its opportunities, NSTA must have more funds. The "one dollar dues" has become woefully inadequate. That is why the Board of Directors proposed and the members voted last December that our annual dues be increased to *two dollars.*

Our membership year on the two dollar basis begins on November 1, 1947. We know that every one of our several thousand members will continue to support NSTA. They will surely recognize the great need for funds and the importance of fostering the continued healthy growth of our national association.

It would be most heartening to the Officers and Directors of NSTA to receive advance membership dues *now* for next year. Won't you write us a personal note of support and encouragement?

MORRIS MEISTER
President, NSTA
1201 Sixteenth Street, N. W.
Washington 6, D. C.

SUMMARY OF NSTA BUSINESS MEETING AND BOARD OF DIRECTORS MEETING, BOSTON, MASSACHUSETTS, DEC 28, 29, 30

In the meeting of the general membership in Boston, the Governing Rules were revised in terms of proposals which had been made and approved by the Board of Directors in the Buffalo meeting during the summer of 1946. Most of the changes in the Constitution and By-Laws have to do with minor details of organization and operation of the association. One major change involves the reduction of the number of General Vice-Presidents from two to one. The section dealing with affiliated societies was clarified as follows: "Affiliated group membership in the NSTA shall not be construed as infringing in any way on the present or future plans or activities of the affiliated group."

Official meetings of the Board of Directors were held on Saturday, Sunday, and Monday of the convention weekend. Highlights of the Board meetings include the following points: Professor K. Lark-Horovitz was appointed to represent the National Science Teachers Association on the council of the American Association for the Advancement of Science. Plans were laid for extended projects and committee work as well as for increased individual and group memberships. The NSTA pledged its cooperation in the movement toward establishing a state talent search as a follow-up of the National Science Talent Search sponsored by Science Clubs of America. The Association approved a report done in cooperation with the Scientific Apparatus Manufacturers Association which deals with suitable types of science equipment and supplies for war devastated countries. The Committee on Professional Relations and Projects was commended for having provided materials such as science radio scripts, a booklet on plastics and Science Teaching Packets as services to the members.

The 1946 NSTA Yearbook was presented at a general meeting on December 30th. The committee was commended for its careful work on the significant topic, "Time for Science Instruction". The Board of Directors approved a plan whereby the Yearbook Committee will issue a series of bulletins of 12 or 16 page length during 1947. The first bulletin is to be entitled, "The Work Week of the Science Teacher". John C. Chiddix, editor and business manager of the official magazine, THE SCIENCE TEACHER, reported that this journal is now listed regularly in the H. W. Wilson Educational Index. It was pointed out that this step will increase the circulation of the journal to libraries and educational institutions and will thus broaden its range of usefulness.

The officers, directors and entire membership of the Association in attendance expressed a vote of thanks to the Boston Arrangements Committee and particularly to Elbert C. Weaver, Chairman.

RESOLUTIONS OF THE NATIONAL SCIENCE TEACHERS ASSOCIATION

Adopted at Official Meeting of
the Board of Directors
Hotel Bradford, Boston, Mass., Sunday,
December 29.

I. Resolved, that the National Science Teachers Association inaugurate a program which will furnish direct aid to the science teacher and to the school administrator for preparing a program which will provide, (1) appropriate and adequate science instruction in the general education program of the non-science student,and (2) adequate science instruction for the potential science specialist; and, furthermore, that a committee be charged with the responsibility for initiating this program.

II. Resolved, That the National Science Teachers Association designate an appropriate person of the staff of the United Nations Educational, Scientific and Cultural Organization to represent the interests of science teachers in the office of UNESCO and that a committee be organized to formulate the policy and measures necessary to maintain this function.

III. Resolved, That the National Science Teachers Association take appropriate steps to effect cooperation with existing agencies who are striving (1) to obtain adequately prepared teachers, (2) to secure salaries commensurate with those in comparable professions, and (3) to distribute information on those conditions of work and professional status which will result in the steady growth in competence, professional standing and service to society on the part of the teacher.

IV. Resolved, That the National Science Teachers Association coordinate the results of pertinent studies relative to science teacher-training in order to bring the best practices to the attention of those responsible for policy regarding teacher-training.

V. Resolved, That the National Science Teachers Association study the appropriateness of instituting awards for contributions to the improvement of science teaching; that such citations be given annually at the discretion of the Association.

VI. Resolved, That the National Science Teachers Association initiate the necessary procedures to bring about close cooperation among the science teachers of the world and institute procedures for the international exchange of materials relative to methods, techniques, and problems of science teaching.

VII. Resolved, That Committee G on Cooperation with Industry be instructed to prepare a list of appropriate projects to be undertaken by the National Science Teachers Association, that this Committee contact industry and labor for guidance regarding such projects and that this Committee take steps to secure specific grants in aid for the support of individual projects.

VII. Resolved, That the Committee on Legislation be instructed to continue its efforts for the consideration by Congress of a measure that shall raise the standards of and equalize the opportunities for science instruction in the high schools throughout the nation.

IX. Resolved, That the counsel and cooperation of the officers of the American Association for the Advancement of Science, and the National Education Association be sought in any meaures which may result from the adoption of these resolutions.

P. F. Brandwein, Chairman
Greta Oppe (absent)
W. B. Buckham
R. W. Lefler
Laurence Quill

ADAPTABLE DISPLAY CASE

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this labor was not included in the above mentioned cost.

These cases are useful for housing clay or whittled models, assembled skeletons of small mammals, birds, amphibia, or fish, and/or mounted bird skins. The size and proportion of any case will depend upon the size specimen to be displayed.

HOW WE GREW UP

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not considered. As more income was available it was used for improving the journal to provide better service.

Merging of Associations

WE HAVE always believed in close cooperation among science teacher associations and have encouraged it in the journal. We have repeatedly urged cooperative and joint effort in meeting the problems of science education and of the science teacher. Consequently when the leaders of the American Science Teachers Association and the American Council, both served by *The Science Teacher*, considered a plan for merging into a single more effective group, we supported the move as a logical one. The National Science Teachers Association was formed (1944). In the three years since its inception it has amply demonstrated the wisdom of forming a single association and has gained recognition for leadership among affiliated and other groups. We are gratified that we have had some part in its development and appreciate the increasing opportunity for service that it provides.

And so in fourteen years the journal has had a record of continuous service for science teacher associations and in building up cooperative effort on a democratic basis—the only basis on which we feel any sustained cooperative effort can exist. Beginning with state associations the journal has extended its support to both state and national groups and has had the unique experience of helping groups work together until cooperation was a natural consequence.

Looking back to the very humble beginning of *The Science Teacher* in association service it is possible to see why some of our good friends wonder at the growth of the journal. Yet those who have been with us all the way understand the development that has come about through the natural course of events.

PUBLICATION problems—production, circulation, advertising, financial, political and diplomatic—that we have had to meet would make a long story themselves. During one of the early years of the journal history one of our good advertiser friends, jokingly said, as he looked at the pages, of the journal, "It does not yet have quite the finesse of a national magazine." That was when the cuts for our illustrations were made by the editor and when low cost printing had to be accepted. Our good friend has long since changed his mind on this score. The publication of a journal is quite an expensive project; and we appreciate the excellent support that we have had from science teachers, from associations, and from our advertisers that makes our present journal possible. The journal is truly a cooperative enterprise and requires many people to meet its problems.

On the road ahead we trust that the journal will continue to serve the purpose for which it was established, to serve science teachers and science teacher associations. We recognize the challenge of an increasing opportunity for service and the necessity of raising the standards of excellence to the highest level. Working together as we have in the past we believe we can attain these goals.

RESUME

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how, somewhere in the germ plasm or in the environment (including exposure to superior teaching) there must grow in the understanding of the teacher the appreciation that no assembly line in commerce or industry is as important to the welfare of the nation tomorrow as the assembly line of children and youth in our homes and in the schools. When that appreciation is present in the teacher or in the prospective teacher, it becomes a primary drive for the life's effort; salaries, income or social approbation become secondary. I should like to see research into the problem whether a person, man or woman, who is seriously motivated in his or her life work by the cosmetics of social approbation will ever become a first-class teacher, either of science or any other subject.

4. If I have any factual understanding of nature and man, past and present, Dr. Lark-Horovitz's proposal for federal financial aid toward the solution of our problem has the earmarks of real statesmanship. On the proposed plan federal funds will be available only to the states that are aware of this problem and are doing something for themselves on the problem. This is sound democracy. We have sufficient experience with federal financial aids to states in agriculture, in infant welfare, and in other fields to know that such aids to states for improved science education can be given without serious political control from Washington and without excessive new growths of federal bureaucracy. But I hope that our cities, counties and states will not rest on their oars on this issue until federal funds start to flow in their direction. Scholarships or loan funds to aid the prospective science teacher towards the best training and experience, and similar aids where needed for continued training of science teachers for ever greater efficiency, when properly administered, can be of great aid towards better science teaching.

However, the old saying that you can lead

a horse (or a mule) to water but you can't make him drink unless he is thirsty is still true. If real thirst for understanding in order to do better work could always be the chief criterion for awarding such scholarships to the financially less fortunate teachers and prospective teachers, there could scarcely be any wiser use of public funds.

5. As a final conclusion it must be pointed out that, even with the best science education, our present understanding, intelligence and experience on the part of first-class teachers, aided by abundance of funds, laboratories and equipment, our fellow citizens thus educated will not always act according to such understanding in individual, national or international affairs, for the cerebrum of man has not yet a complete control over the hypothalamus, even during the waking hours. And the hypothalamus, this ancient part of the brain which we have in common with the fish, the toad and the snake, largely controls our greed, our vanity, our faiths, our hopes, our fears and and prejudices.

I think, however, we can say without contradiction that if the plans developed at this hour by our four colleagues were completely carried out, more of our fellow citizens of tomorrow would act on understanding rather than ignorance a greater part of the time. I think we will agree that even this partial success is worth all our effort, particularly in the field of tomorrow—that is, the long view ahead. Action on the basis of factual scientific understanding is becoming more and more important for the future of man.

WRITE FOR IT

What's New in the World of Science, Volume V is a twelve page booklet distributed by the General Electric Company, Schenectady 5, New York. It includes many of the subjects treated in the General Electric Photo News Service posters during the school year 1945-6 and develops them more fully than it is possible on a poster.

BETTER SCIENCE TEXTS

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minds and when these illustrations are part of a text written by learned men and accepted by accredited educators, what is there to keep the pupil from believing otherwise than that the image arrow is straight?

Another weakness of our texts, already mentioned, lies in the careless use of terminology. At times textbook procedures lead one to believe that there is something inherently wrong in insisting upon precise definitions, preferably before a word is used in discussion. Educators who deem it advisable to detour around excessive formal definition are to be commended but should not be allowed to sidetrack all definitions, because by so doing more harm than good may again be harvested.

One such example has already been given in the discussion of loudness and intensity.* A better example involves the word "overtone." Consider two statements made by one popular text.

(1) "A frequency which is a multiple of the fundamental is called an overtone."

(2) "The overtones of bells and plates are not whole number multiples of the fundamental."

Even though statement (1) was located in the discourse on strings, it was not qualified in any way. From both statements a good pupil could infer the true meaning of "overtone," but a poor pupil would simply be baffled. Why not define or at least use the word correctly in the beginning? Why bandy it about hoping by some stroke of fortune that its correct meaning will be inferred? As though this were not bad enough a second text boldly states, "These other and higher notes are called overtones or harmonics," definitely making the two terms synonomous.

Another irritating situation arises in teaching when the pedagogical approach to the solution of a problem calls for the changing of methods in midstream. How many teachers have had their pupils determine the mechanical advantage of a conventional pulley system by counting the supporting strands and then later without further elucidation ask their pupils to calculate the mechanical advantage of a Spanish Burton or some other unorthodox system? Now, strange as it may seem, the method used to explain the conventional does not explain the Burton, but the method that explains the unorthodox very easily explains the conventional. Why not adopt the more general explanation in the first place? It is not possible to find the number of supporting strands in all cases but it is always easy to use the principle based on the fact that the tension in a rope is constant throughout. The pupil is not at fault when he cannot solve the mysteries of the Spanish Burton or the Fool's Tackle when he has been led to believe that counting supporting strands will do the trick.

How many have wondered why in explaining the electrolysis of water it is assumed that, "at the anode the sulphate ions lose electrons,

*Two other words as hopelessly confused are "tone" and "note."

but the resulting atoms act on the water, setting free oxygen and forming sulphuric acid again." The charging of the lead cell, *an identical* situation, is explained by saying, "The sulphate ions, released from the lead sulphate, go back into the solution, increasing its strength. This releases oxygen from the water of the electrolyte to form lead peroxide again."

Equations illustrating the first explanation include

$SO_4^{-2} \rightarrow SO_4^{0} + 2e$
$SO_4 + H_2O \rightarrow H_2SO_4 + O$

The second case includes the following—

$H_2O \rightarrow 2H^+ + O^{-2}$
$SO_4^{-2} + 2H^+ \rightarrow H_2SO_4$
$Pb^{+4} + 2O^{-2} \rightarrow PbO_2$

Even though there is doubt in the chemist's mind as to what actually transpires in the electrolytic cell, cannot one of these two explanations be accepted to cover both cases? After all, is it not our purpose in physics to explain the movement of the electrons in the simplest way possible? Let the chemist point out which method is preferable so one explanation can be used to explain both cases.

Most teachers of physics have noted errors similar to those given above. The pitfalls discovered by one, however, may not be the same as those discovered by another. Why can we not, through the medium of our excellent magazine, exchange articles of this sort? Not only will much good accrue to us as teachers but also the writers of textbooks may take our criticism to heart and offer us something better from which to instruct. Although this article deals wholly with physics, one should not infer that the other fields of high school science are not subject to similar investigations. Biology and chemistry teachers, therefore, are also invited to join in the fray.

WRITE FOR IT

Adventures in Electricity is a three booklet series also distributed by the General Electric Company. It is done in four colors using the "comic" technique. No. 1 is Generation and Transmission of Electricity (GEC-174); No. 2, Uses of Electricity (APG-17); No. 3, Distribution of Electricity (APG-17-1).

VISUALIZING SCIENCE

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unit heading, as some of them may be used to illustrate concepts approached from several different angles. The number (1-13) following the filmstrip title in the list refers to the source of the same. The letters (A to E) refer to the rating of the filmstrip. A number of factors were considered in assigning these ratings such as, clearness of concepts presented, conciseness, appropriateness of the subject matter for the unit, script on the film, photographic excellence, etc. The free filmstrips are marked with the letter (F). Those that are accompanied by a manual or study guide are followed by the letter (M). Filmstrips that are in color are indicated by the letter (K) following the title. For additional information regarding the classification of the filmstrips, refer to the key which follows the classified listing.

Filmstrips in the following list pertain to the biological aspects of science study. In a later issue will appear a list of filmstrips relating to the physical sciences.

FILM RATING:

A—Very good
B—Good
C—Satisfactory
D—Fair
E—Poor

Ratings follow the listing of the titles of the filmstrips.

Manuals:

M—Follows all titles that are accompanied by study guides.

Color:

K—Follows all titles that are in color.

Script:

S—Follows all titles that have the script or printed explanation on the film.

Key: FILM SOURCES

1. Society for Visual Education
100 East Ohio St., Chicago, Illinois
2. Dewey & Dewey
Kenosha, Wisconsin
3. Stilfilm, Inc.
8443 Melrose Avenue, Hollywood 46, California

4. Castle Films, Inc.
   30 Rockefeller Plaza
   New York 20, New York
5. Metropolitan Life Insurance Co.
   New York City
6. Coronet Films
   919 North Michigan Avenue.
   Chicago 11, Illinois
7. General Electric Company
   Publicity Dept.,
   Schenectady, New York
8. Eye Gate House, Inc.
   New York City
9. American Council on Education
   Washington, D. C.
10. United Airlines
    5959 South Cicero Avenue,
    Chicago, Illinois
11. Visual Sciences
    Suffern, New York
12. Jam Handy
    230 North Michigan Avenue.
    Chicago, Illinois
13. Radio Corporation of America
    Camden, New Jersey

Agriculture; Soils; Gardening

Soil Conservation 9-C-M
Irrigation 9-C-M
Soil Conservation & Wildlife 2-B-M-S
Insect Pests of Garden Vegetables & Their Control 2-A-S
History of Agricultural Implements 2-B-M-S
Farm Water Supply 2-C-M-S
Soil Erosion in the U. S. 2-A-S
Farm Water Supply 2-B-S
Grasshoppers & Their Control 2-B-S
Weathering & Wind Deposits 1-C-M
Gardening Cartoons 2-A-S

Anatomy and Physiology

The Heart and How It Works 2-A-S
The Urinary System 2-A-S
Bloodvessels and Their Functions 2-A-M-S
Bones and Muscles 2-A-S
X-Rays 7-D-M-F
Functions of Living Things 2-A-M-S
Elementary Physiology 2-C-M-S

Animals

Monarch Butterfly 1-A-S
Arthropods 11-B-S

Concluded in October Issue

NECESSITY OF SCIENCE LEGISLATION

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Bush report estimates a maximum total of 24,000 scholars should be reached, an undertaking obviously only possible if the state and federal government collaborate.

Funds provided in part by the states and in part by the federal government would make it possible to provide scholarships which would eliminate the economic factors determining at the present time the selection of the students who are able to go on with science training. Again, local screening programs sponsored by the state would insure the necessary freedom from federal control. Careful selection based on screening would make it possible to maintain the man-power reservoir which is necessary for a sound development of scientific work in the future.

WE, THEREFORE, recommend the formulation of a program of science legislation, emphasizing the points which are free of any controversy and have found the support of all groups.

(1) A high school science act to support science education, including teacher training programs and science counseling, administered through the states.

(2) A scholarship program based on carefully coordinated screening, administered locally, but based on nationally agreed standards.

By unifying these programs, we may hope to arrive at a solution acceptable to the local communities and serving the country as a whole.

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Southern California Science Teachers Association

President, Garford G. Gordon, Susan Dorsey High School, Los Angeles
Vice-President, Marion E. Taggart, LaCumbre Jr. High School, Santa Barbara
Secretary, Rollin Enfield, Pamona High School
Program Chairman, Alexander Frazier, L. A. Co. Coordinator, Pasadena

Tennessee Science Teachers Association

President, Jacob W. Shapiro, Central High School, Columbia
(Notice of affiliation received as we were going to press.)

Texas Association of Science Teachers

President, Addison Lee, University of Texas
Secretary, Greta Oppe, Ball High School, Galveston
Consultant, Miss Greta Oppe, Ball High School, Galveston

BOOK SHELF

THE WONDERWORLD OF SCIENCE, BOOK NINE. Morris Meister, Ralph E. Keirstead, and Lois M. Shormaker. Illustrated by Alma Froderstrom and Thomas Voter. Charles Scribner's Sons, New York City, 1946. 698 pp., 14x19.5 cm., with 364 illustrations. Price $2.20.

The Wonderworld of Science, Book Nine, is designed to give ninth grade students some understanding of the world about them, extending the scientific concepts already gained and allowing them to explore the various fields of science. In doing this the social implications of advances through science are included. The need for conserving materials is stressed and the problem of good health is given much attention.

The book is divided into ten units with each unit comprising two or more chapters. Each chapter catches the interest of the student by starting with some biography, an adventure, or a description of an experiment. The chapter is further divided into problems which are solved through reading or experimentation, or both. At the end of the chapter is included a list of suggested activities for further exploration.

The text is interesting, well illustrated, and keyed to the ninth grade level in vocabulary and understanding. Illustrations are particularly well suited to the accompanying text.

HEALTH CARE OF THE FAMILY. Ramona L. Todd, Students' Health Service and School of Public Health, University of Minnesota; and Ruth B. Freeman, School of Public Health, University of Minnesota. W. B. Saunders Company, Philadelphia and London, 1946. 530 pages, 13x19.5 cm., 69 illustrations. Price $3.00.

Health Care of the Family is best suited to the college student, but is a very useful book for any one interested in this field, especially by those considering marriage and raising of a family. The material presented in the book has been selected to meet the need of college students for a comprehensive textbook on family and health conservation.

The book is organized in four parts: *Environment and Prevention of Disease; Reproduction; Individual Health Care;* and *Home Care of Illness.* Sex, reproduction and related problems are quite fully and sanely treated and given the attention their importance in family life warrants.

Procedures for home care of the sick or injured are organized for convenience of reference. For example, under *Irrigations* the purposes are enumerated, principles given, get ready indicated, and the procedures outlined. This makes the book especially valuable in the home and for the nurse.

The book is simply written and is easily understood, even by the layman.

INTRODUCTION TO EMULSIONS. George M. Sutheim. Chemical Publishing Company, Brooklyn, N. Y., 1946. 260 pages, 13.5x21.5 cm., illustrated. Price $4.75.

For the practical chemist, as well as student, who wants to improve his working knowledge of emulsions and of the principles involved in their formulation, *Introduction to Emulsions* will be found most helpful. It is particularly easy to read and understand and yet thorough in presentation.

Two chapters are given to a discussion of the physical and chemical properties of emulsifying agents. Each group of emulsifying agents is thoroughly treated, indicating the chemical composition and reactions involved and the advantages of the various groups for special applications. Other chapters include the formation of emulsions, properties of emulsions and their application.

The book is quite up to date and discusses emulsifying agents in current use. A comprehensive alphabetical list of these agents is included in table form, listing also commercial names, chemical composition, group to which they belong, type of emulsion produced, and name of manufacturer.

ELECTRIC MOTOR REPAIR. Robert Rosenberg. Murray Hill Books, Inc., New York City, 1946. 570 pages, 900 illustrations. Two-section spiral wire binding. Price $5.00.

This non-technical treatise on the repair of motors, generators and controls deals with problems relating to diagnosing, trouble-shooting, repair and rewinding data. The text section of this dual book comprises over 300 pages. The other section of 243 pages contains the illustrations. The binding permits both sections to be operated like two separate books so that a particular illustration may be opened to view to correspond with a particular page in the text. J. S.

SEMIMICRO LABORATORY EXERCISES IN HIGH SCHOOL CHEMISTRY. Fred T. Weisbruch. D. C. Heath & Co., Boston, 1946. 269 pp. 20x27 cm. Price, $1.48.

In this manual the author has adapted the semimicro techniques of the college laboratory to the needs of students in the high school. He believes that the semi-micro method of laboratory procedure "frees the instructor for individual classroom teaching; provides greater flexibility in laboratory programs; makes for a cleaner, neater, more healthful laboratory; is less expensive than traditional laboratory methods."

The manual follows the plan of the usual macro manual as to order of experiments and their organization into units. The experiments may be chosen in any order. Most of the experiments require a double laboratory period for completion. Ample space is left after each question for the student to write in the answer. Self testing exercises are included at the close of each unit.

A teacher's manual is also available to guide the teacher in changing over to semi-micro laboratory instruction.

NEW WORLD OF CHEMISTRY. Bernard Jaffe. Silver Burdett Company, New York, 1947. 710 pp. 15.5x22.5 in. 435 illus. List price, $2.88.

This 1947 revision of Jaffe's chemistry text is an interesting and readable book that permits the student to study science principles and facts in rela-

tion to consumer goods and their uses. This close tie-up with common and also uncommon things develops and sustains interest.

The organization remains the same as in the earlier text, but much new material has been added including nuclear fission, streptomycin, silicones, DDT, new detergents, synthetic rubber, high octane gasoline, and molding of plastics.

At the end of each chapter are useful summaries, suggested readings, problems to solve, and possible projects. A 6-page list of educational films in chemistry is included. Also available is a laboratory manual and workbook to accompany the text and a key to the exercises.

CHEMISTRY AND HUMAN AFFAIRS. Clifford J. Scott, High School, East Orange, New Jersey; and George Howard Bruce, late of Horace Mann School for Boys, Teachers College, Columbia University. World Book Co., Yonkers, New York, 1947. 788 pp. 14½x22 in. Illustrations. Price $2.68.

Chemistry and Human Affairs is neither of the academic college preparatory type nor on the consumer science level. In it the authors have attempted to present the principles of chemistry in as simple form as possible without over-loading the student with difficulties that are not needed for an understanding of the subject. Difficult equations and complicated reactions have been kept to a minimum.

The explanation of the theory of chemistry is done very simply and in terms the student can understand. Experiments are described to make the discussion concrete and clear.

There are 17 units, arranged somewhat in the usual order. Each unit has its own introduction, is divided into four or more problems, and closes with a section on "Applying What You Have Learned." References for outside reading are also given.

The book is attractive, well written, and is well suited to instruction for the *average* student.

HANDBOOK OF MICROSCOPIC CHARACTERISTICS OF TISSUES AND ORGANS. Third Edition. Karl A. Stiles. The Blakiston Co., Philadelphia. 214 pp. 15x23 cm. Illus. Price, $1.75.

The third edition of the *Handbook of Microscopic Characteristics of Tissues and Organs* follows the same general plan of the earlier editions but has been extensively revised. New sections have been introduced on the cell, mitosis, development of bone, oral cavity, tongue, teeth, hair, nails, organs of taste, and other parts. New analytical illustrations add much to its value. The glossary has been greatly increased and a bibliography has been included.

The *Handbook* is designed to supplement a regular histology text. It can be used as a laboratory manual and also will serve well for review purposes.

FINAL JUDGMENT. Victor H. Bernstein. Boni & Gaer, New York City, 1947. 290 pp. $3.50.

The chapter called, "SCIENCE," provides a revealing picture of the debauchery of science under the Nazis. But the perplexity in the mind of every admirer of science, the student, the teacher of science, is how science could be so degraded. How was the land of Koch, of Einstein, of Ehrlich so abased as to accept such a brutal perversion, a science that is the antithesis of science? You will wonder whether this anomaly has been eradicated. You will wonder whether the same seed does not lie dormant in our own nation. Therein will you find the value of this book, because the science chapter is presented in the corallary background of political, social, economic and psychological degradation of Nazi Germany. It is a stirring account of the Nazis, from their inception on through the Nuremberg trials, fast moving, factual, authentic. The book reveals hitherto unpublished documents, documents not introduced at the trials, not reported in the press. The book belongs on every library shelf, in every home. J. S.

BACTERIAL CHEMISTRY AND PHYSIOLOGY. John Roger Porter, Associate professor, Department of Bacteriology, College of Medicine, State University of Iowa. John Wiley and Sons, Inc., New York, 1946. 1073 pp. Price $12.00.

Bacterial Chemistry and Physiology is a comprehensive text in bacterial physiology on the graduate level in college. It is designed to give a background of development in chemistry related to micro-organisms or to physiological reactions of importance that can be studied or produced by bacterial action. The following chapter headings indicate the scope of the book: *Some Physico-chemical Properties of Bacteria and Their Environment; The Growth and Death of Bacteria; The Effects of Physical Agents on Bacteria; The Effects of Chemical Agents on Bacteria; The Chemical Composition of Microorganisms; Bacterial Enzymes and Bacterial Respiration; Bacterial Nutrition; Metabolism of Carbon Compounds by Microorganisms; Metabolism of Compounds by Microorganisms; Microbial Fermentations.*

It can be seen from the above chapter headings that the book is best suited to the needs of students majoring in chemistry or in pharmacy and biology.

The book covers the topics discussed quite thoroughly, citing investigators, giving their procedures in brief and their findings. An extensive bibliography included at the end of each chapter permits the student to go to the original source for further information.

A TEXTBOOK OF QUALITATIVE ANALYSIS. William Buell Meldrum, Haverford College; and Albert Fredrick Daggett, University of New Hampshire. American Book Company, N. Y., 1946. 431 pp. Price, $3.50.

Weaving new ideas and methods into a course and at the same time retaining the time tested essentials of a subject area is a difficult problem

in chemistry which Professors Meldrum and Dagget seem to have met with much success in *A Textbook of Qaulitative Analysis.*

Semimicro technique now accepted in many college classes is used throughout. The use of organic reagents for the detection of ions, particularly traces, is kept to a minimum. This is desirable inasmuch as their reactions are too complex for understanding by first and second year college students and are of limited usefulness as illustrations of fundamental chemical principles.

The Lowry-Bronsted acid-base concept is used in the explanation of reactions. Ionization constants and solubility products are considered in terms of concentrations, however, although the concept of activates is mentioned. Brief chapters are included on electro-chemistry.

The plan of analysis is adequate. The book will be found satisfactory for the college qualitative analysis course.

SCHOOL GARDEN

Continued from Page 68

is effective. Trips, "treats," picnics, etc., open only to those who reach a specified grade level, often prove helpful in keeping up attendance and interest. Evening visits for parents and others, stimulate good work on the part of the youngsters and community appreciation of their work.

A school garden show about the time school opens in September, with plenty of ribbon awards, will be found to mean a lot to the young gardeners. It is also good publicity. Valuable prizes are unnecessary if not undesirable.

Harvesting of late crops should continue after school is in session. The pupils should also participate in the final activities of the season in the garden, such as cleaning up the crop refuse, and sowing a winter cover crop of rye.

Concluding the Season

The final event of the year should be suitable achievement ceremonies, held in late October or early November. This is the time to recognize every boy and girl who carried through the season, with a certificate of achievement. Simple prizes for outstanding gardens are also desirable if equitably awarded.

Note: Anyone interested in definite individual plot plans for pupils in school gardens of the sort described above, may obtain samples of plans which have been used in school gardens in Cleveland, Ohio. Write to Paul R. Young, School Garden Supervisor, Board of Education, Cleveland 14, Ohio.

THIS AND THAT

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chairman; W. Bayard Buckham, Rollen Enfield, Adrian Gentry, and Garford G. Gordon.

Mr. Gentry is chairman of the local arrangements and will be ably assisted by Dr. John Carroll, Paul Farrar, Lowell Pierce and others.

Recent Affiliations

We are happy to welcome the following organizations to our ever growing list of "Affiliates"—

Detroit Biology Club

National Association for Research in Science Training

Tennessee Science Teachers Association